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A NOVEL TRIFOLIOLATE SPECIES OF *ARACHIS* (FABACEAE) AND FURTHER COMMENTS ON THE TAXONOMIC SECTION *TRIERECTOIDES*.

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Summary: Valls, J. F. M., L. C. Costa & A. R. Custodio. 2013. A novel trifoliolate species of *Arachis* (Fabaceae) and further comments on the taxonomic section *Trierectoides*. Bonplandia 22(1): 91-97.

A new species of *Arachis*, with trifoliolated leaves, *A. sesquijuga*, is described. It differs from the other trifoliolated species, both with ternate leaflets, by the presence of an evident rachis, which makes the leaves clearly pinnate. Historical facts about the accumulation of knowledge about the rare trifoliolate species of *Arachis* are commented in a chronological sequence.

Key words: *Arachis*, taxonomy, new species, Leguminosae.

Resumen: Valls, J. F. M., L. C. Costa & A. R. Custodio. 2013. Una nueva especie trifoliolada de *Arachis* (Fabaceae) y comentarios adicionales sobre la sección taxonómica *Trierectoides*. Bonplandia 22(1): 91-97.

Se describe una nueva especie de *Arachis*, con hojas trifolioladas, *A. sesquijuga*. Esta se diferencia de las otras especies trifolioladas, ambas con folíolos ternados, por la presencia de un raquis evidente, lo que caracteriza a la hoja como pinnada. Datos históricos sobre la acumulación de conocimiento referente a las raras especies trifolioladas son comentados en secuencia cronológica.

Palabras clave: *Arachis*, taxonomía, nueva especie, Leguminosae.

Introduction

Pinnate tetrafoliolate leaves prevail in *Arachis* L. However, random occurrence of one, or most rarely two small supernumerary leaflets is frequent in young plants of *A. stenosperma* Krapov. & W.C.Greg. (Krapovickas & Gregory, 1994), and may occasionally appear in other species, such as in assorted populations of *A. pusilla* Benth.

Trifoliolate basal first, and eventually second leaves are commonly observed in otherwise tetrafoliolate lateral branches of species of sect. *Extranervosae* Krapov. & W.C.Greg., most frequently in *A. marginata* Gardner.

So far, only two typically trifoliolate species have been formally described in the genus: *A. tuberosa* Bong. *ex* Benth. and *A. guaranitica* Chodat & Hassl.

Arachis tuberosa is one of the first five wild species formally attached to the genus by Bentham (1841), 88 years after its description based on a single species, *A. hypogaea* L., the cultivated groundnut (Linnaeus, 1753). The name *A. tuberosa* was consistently attributed by Bentham (1841, 1859) to August Gustav

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Heinrich von Bongard (1786-1839), a German Botanist based in St. Petersburg, Russia. Working on Riedel's herbarium specimens collected in 1826 (Riedel 605), showing a few flowers, but deprived of fruit segments, Bongard was the first to understand the relationships of this wild trifoliolate legume to the then monotypic genus *Arachis*.

When describing *A. tuberosa*, Bentham (1841) did not refer to its peculiar trifoliolate leaves. His five new species were characterized as having tetrafoliolate leaves, and no mention was made to the divergent condition of *A. tuberosa*. But this has been corrected in his subsequent treatment of *Arachis* in Flora Brasiliensis, where Bentham (1859) refers to "… *Folia pinnatim bijuga v. [vel] rarius trifoliolata* …", in the generic circumscription, and specifically to "… *foliolis ternis*…" and "… *Foliola ad apicem petiole semper terna videntur*…" in the description of *A. tuberosa*. Therefore, in 1859, Bentham not only mentioned the correct number of leaflets, but also pointed to their common, "always ternate" insertion at the tip of the petiole.

Sixty three years after the description of *A. tuberosa*, Chodat & Hassler (1904) described *A. guaranitica*, based on the collection Hassler 4975, made in 1898 (Krapovickas & Gregory, 1994), as a new species with "… *foliola 3 lineari-lanceolata ...*", showing affinities ("… *An mere varietas?...*") to *A. tuberosa*, but no reference was made to the ternate condition of the leaflets.

Having studied the *Arachis* collections at the Kew Herbarium (K) in 1922, and in the Paris Museum Herbarium (P) from 1922 to 1931, Auguste Chevalier had access to the holotype and isotypes of *A. tuberosa*, and to isotypes of *A. guaranitica*. He accepted the trifoliolate taxa as distinct species, which he included for the first time in a dichotomous key, considering "… *folioles oblongues, souvent rétuses au sommet (A. tuberosa) x folioles linéaires, atténuées aux deux extrémités (A. guaranitica)…*" (Chevalier, 1933). Citing the original collections only, Chevalier confirmed the geographic distribution of *A. tuberosa* in Brasil, and of *A. guaranitica* in Paraguay.

In his account of the Leguminosae-Hedysareae of Argentina, Burkart (1939) followed Chevalier's concepts on the genus *Arachis*, and referred to "… *hojas paripinadas biyugas (en dos especies de Brasil y Paraguay trifolioladas)* …". Interestingly, in his later treatment of the Argentinian Legumes (1952), Burkart mentions leaves "… *rara vez trifolioladas (en dos especies paraguayas)* …" Whether Burkart had hints on the potential occurrence of *A. tuberosa* in Paraguay is not clear, but no specimens have been found so far to document his late statement.

In his comprehensive and well illustrated treatment of the genus *Arachis*, Hoehne (1940) referred to "… *fôlhas em regra pinadas com dois jugos de folíolos, às vezes (em uma ou duas espécies) trifolioladas sendo então os folíolos inseridos na extremidade do pecíolo na mesma altura, sem raque intermediária;* ...". Alongside with the first and excellent illustrations he provided of both trifoliolate species, Hoehne clearly confirmed the ternate condition of the leaves of the Brazilian *A. tuberosa* and the Paraguayan *A. guaranitica*. However, additionally to two specimens of *A. tuberosa* collected by Jorge Ramos de Otero (Otero 192 and 452), with duplicates available in his local herbarium, Hoehne refers to a photograph available in the Herbarium of the United States National Arboretum, in Washington, which he considers of the type specimen, allegedly collected by Sellow, and deposited in the Berlin Museum Herbarium (B). This confronted the previous association of the name *A. tuberosa* to a single collection made at Rio Pardo (Bentham, 1841) by Riedel (Bentham, 1859), which had been formally designated as the type by Chevalier (1933). Riedel's specimen was not cited by Hoehne.

A photograph of a freshly collected plant of *A. tuberosa* was published by Otero (1941), in his survey of the natural grasslands of Mato Grosso State. Otero collected *A. tuberosa* in the surroundings of Campo Grande, as cited by Hoehne (1940), and referred to its scarce occurrence. Although manifesting a sheer enthusiasm on the forage potential of *Arachis* species and having collected *A. pseudovillosa* (Chodat & Hassl.) Krapov. & W.C.Greg twice (collection numbers 283 and 362) in the area of Ponta Porã, Otero did not collect *A. guaranitica*, a species frequently found in

sympatry with *A. pseudovillosa* in that area.

The presence of *A. guaranitica* in Brazil was only documented in 1959, when three germoplasm and herbarium collections were made by W.C. Gregory, A. Krapovickas, and J.R. Pietrarelli (collection numbers 9665, 9701 and 9780) in the area of Amambay-Ponta Porã-Antonio João, of today's State of Mato Grosso do Sul (Krapovickas & Gregory, 1994), along the border with Paraguay, in the same Maracaju hills, where the type specimen had been collected by Hassler, in the Paraguayan slope, some 60 years before.

In the next monographic treatment of *Arachis*, Hermann (1954) provided pictures of an isotype of *A. guaranitica* (Hassler 4975, F) and of the specimen of *A. tuberosa* incorporated to the Berlin Herbarium (B), allegedly collected by F. Sellow, which he also cited as the type of that species. It seems worth to mention that, in spite of his intensive travelling in Brazil, Sellow has never been in the natural area of occurrence of *A. tuberosa*, circumscribed by Hermann, repeating Hoehne (1940), as "… *Plains of Camapuan, the Rio Pardo, and the vicinity of Campo Grande to Coxim, Matto Grosso, Brazil* …" and also reaching the State of Goiás (Krapovickas & Gregory, 1994). On the other hand, while in Brazil, Sellow has been in contact with Ludwig Riedel (Hoehne & al., 1941), who made the Rio Pardo collection sent to St. Petersburg, where Bongard characterized it as a species of *Arachis*, and provided duplicates to Paris (P) and Kew (K). The Riedel 605 duplicate in K, studied by Bentham, is the true holotype of *A. tuberosa*. It is quite possible that the Berlin specimen attributed to Sellow is in fact an additional duplicate of Riedel's type collection, and its phenological characteristics coincide with Riedel's specimens deposited at K and P. Although not mentioned in the text, the ternate condition of the leaves of both trifoliolate species is clearly shown in the pictures.

In two preliminary proposals for a sectional subdivision of the genus, the trifoliolate species were alternatively included in the yet informal series *Trifoliolatae* of section *Erectoides* (Gregory & al., 1973), or in a section of their own, the *Trierectoides*, also not effectively published in nomenclatural terms (Krapovickas, 1973).

The subsequent treatment of this pair of species with trifoliolate leaves (Krapovickas & Gregory, 1994) stressed their singularity, by the formal establishment of *sect. Trierectoides* Krapov. & W.C.Greg. and emphasized their close relationships to the equally perennial tetrafoliolate species gathered in the parallel sect. *Erectoides* Krapov. & W.C.Greg.

Recent collecting expeditions undertaken in the general area of occurrence of the trifoliolate species of *Arachis* in Brazil, over an additional century after the first collection of *A. guaranitica* by Hassler, and 184 years after the original collection of *A. tuberosa* by Riedel, have yielded a third, quite distinct species with trifoliolate leaves, which we describe here.

Arachis sesquijuga* Valls, L.C.Costa & Custodio *sp. nov.

Fig. 1, 2

Arachidi tuberosae Bong. ex Benth. affinis, sed foliis pinnatis differt.

Typus: **BRASIL: Mato Grosso do Sul.** Mun. Sidrolândia, rodovia MS-162 Sidrolândia-Maracaju, área suavemente ondulada com agricultura e pastagens cultivadas, 21º 19' 40.4" S/ 55º 4' 4.5" W, 487 m.s.m., 17.X.2010, *J.F.M. Valls, R.C. Oliveira & W.O.O. Edward 15487* (*holotypus* CEN, *isotypi* CTES, UB).

Perennial, up to 40 cm tall. Branched tuberous roots. Terete, not thickened mainstem. Additional branches developing from the base of the plant. Branches simple, unbranched at the base, eventually branched at variable heights when grazed; hairy nodes and internodes. Trifoliolate leaves. Stipules 22.2-22.7 (14.7-29.2) mm long, ciliate throughout the margins, well marked longitudinal veins; adnate portion 10.7-11.3 (7.2-14.7) mm long with margins partially fused at the base, forming a short tube up to 3 mm long; free parts 11.4-11.6 (6.3-16.1) mm long, 0.8-1.1 (0.5-1.3) mm wide. Petiole canaliculate, hairy throughout its extent, 4.2-5.5 (2.6-7.8) mm long, 0.9-1.1 (0.5-1.1) mm wide. Leaflets oblanceolate with obtuse to broadly acute apex, glabrous epiphyll and hypophyll (bristles eventually present in the hypophyll), margins ciliate and trichomes throughout the main vein. Basal

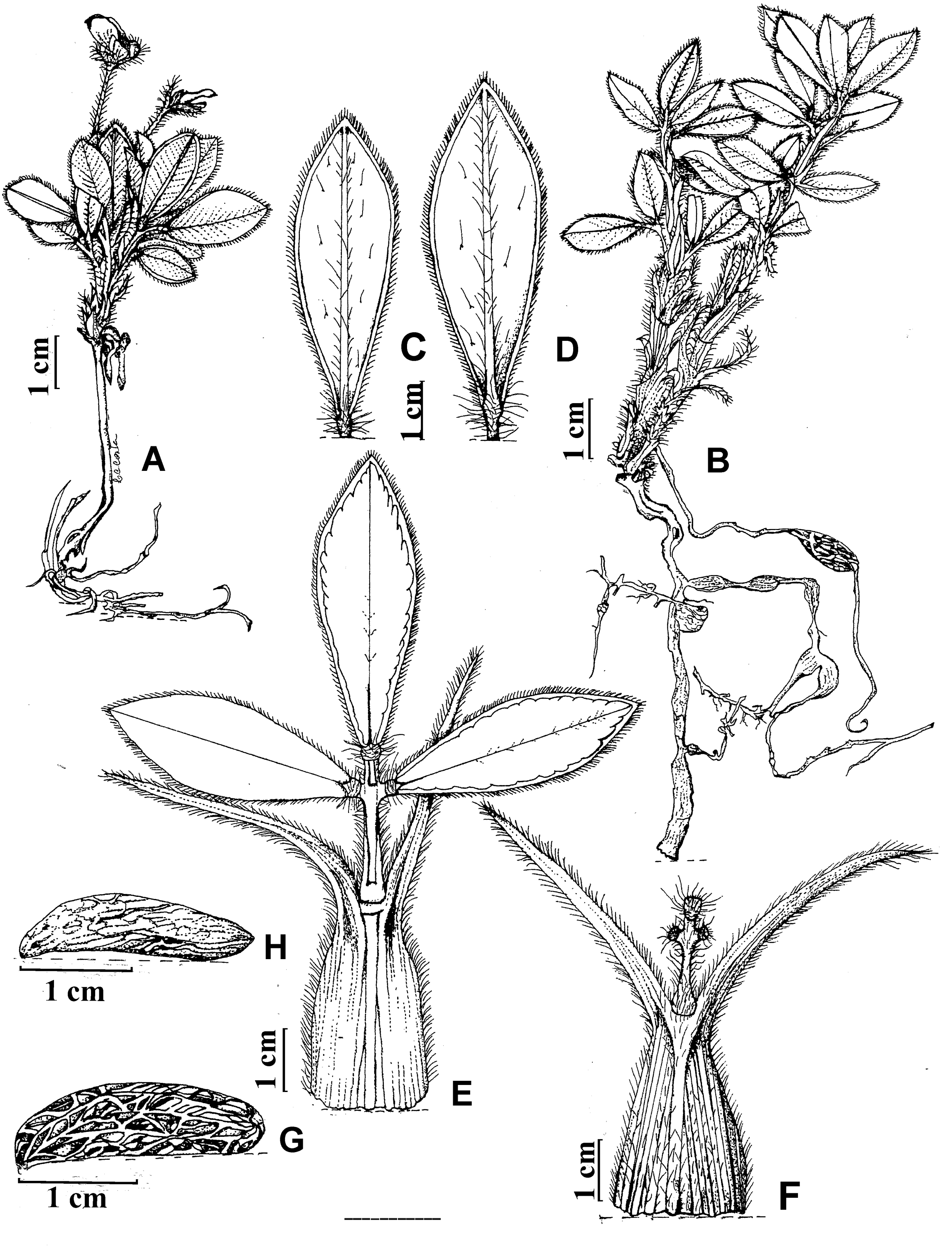


Fig. 1. *Arachis sesquijuga*. A: recently germinated plant, still showing cotyledons. B: habit of adult plant with fruit segment. C: basal leaflet, abaxial view. D: distal leaflet, abaxial view. E: leaf, adaxial view. F: leaf (leaflets removed), abaxial view. G: fruit segment without epicarp, showing reticulated mesocarp. H: seed. (A-H, *Valls & al. 15487*).

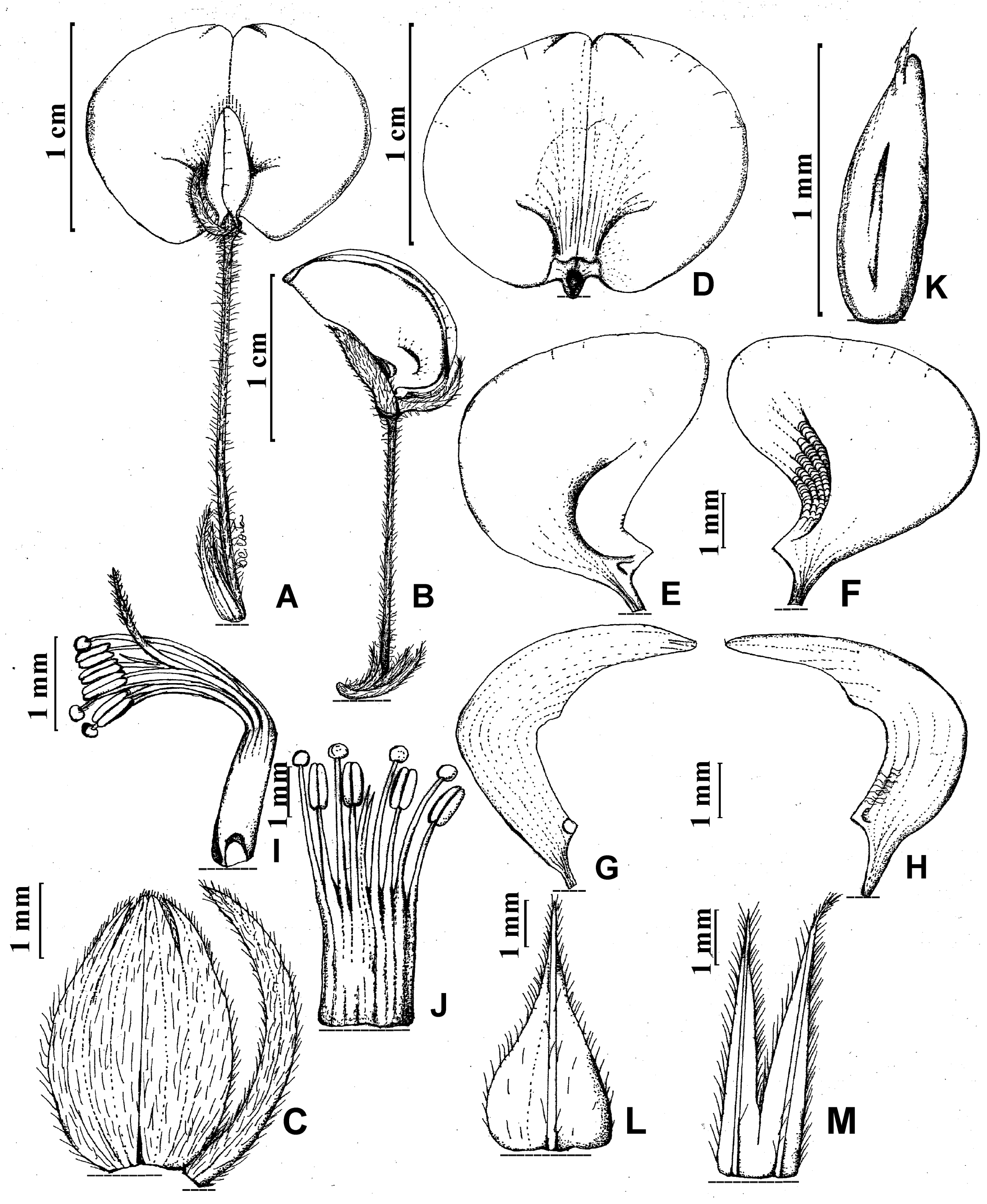


Fig. 2. *Arachis sesquijuga*. A: flower. B: flower bud. C: calyx. D: standard petal. E: wing petal, adaxial view. F: wing petal, abaxial view. G: keel petal, adaxial view. H: keel petal, abaxial view. I: androecium with style and stigma. J: open androecium. K: ovary. L: external bract, abaxial view. M: internal bract, abaxial view. (A-M *Valls & al. 15563*).

leaflets 22.1-23.8 (13.3-31.2) mm long, 7.2-9.1 (4.7-10.7) mm wide. Rachis canaliculate, ciliate throughout the whole length, 2.2-3.0 (1.6-4.3) mm long, 0.7-0.9 (0.4-1.0) mm wide. Distal leaflet 22.7-26.0 (15.2 to 36.7) mm long, 8.1-10.5 (6.2-11.9) mm wide. Inflorescences with 4-6 flowers, each subtended by two paleaceous, green bracts, both pubescent, with ciliate margins. External bract acuminate, 8.7-9.6 x 2.1-2-9 mm, narrowly acute, 1-nerved; internal bract laciniate, bidentate, 3.8-4.3 x 1.4-2.1 mm, 2-nerved. Extended flowers 65.6-75.3 mm tall. Hypanthium 53.7-67.7 x 1.1-1.2 mm, green to purplish green, densely tomentose. Upper lip of calix resulting from four laterally fused sepals, broadly elliptic, dense-tomentose, 6.3-6.9 x 4.5-5.1 mm long, the two central sepals fused almost to the apex, the lateral ones marginally fused to them up to 3/4 of their lenght; lower lip of calix falciform dense-tomentose, slightly longer. Standart orange, suborbicular, slightly emarginate, with golden-yellow macula and rounded claw, folded at the insertion of wings, 10.2-12.0 x 12.1-16.3 mm; yellowish-orange wings, curved-spatulate, rounded apex, 6.0-6.7 x 6.0-7.0 mm long, upper basally to centrally lunate-sculptured, 2.2-2.7 x 1.1-1.4 mm wide, orange striate, with attenuate auricle, adaxial pocket at base of auricle internally projected towards base of keel petal; keel petals falciform, pale yellow, 8.8-9.0 x 1.7-1.8 mm, upper basally lunate-lamellate-sculptured, attenuate auricle, with pocket where adaxial projection of wing pocket is inserted. Androecium 8.0-8.8 x 2.0-2.8 mm long, four long stamens with oblate anthers, four shorter stamens with oblong anthers. Trichomes at stigma extending towards upper portion of style, ovary elliptic. Fruit segments 15.3 x 5.2 mm in average (9.9-21.8 x 4.6-7.2 mm), mild to moderate beak, moderately reticulated, epicarp often detached. Pegs green or purplish-green in the aerial part. Seeds variable in size, elongate, dorsiventrally compressed, with prominent beak, 9.5-16.0 x 4.5-7.0 mm, light to dark-brown tegument. 2n=2x=20 chromosomes.

Paratypus: **BRASIL: Mato Grosso do Sul.** Mun. Sidrolândia, rodovia MS-162 Sidrolândia-Maracaju, área suavemente ondulada com agricultura e pastagens cultivadas, 21º 19' 36.8" S/ 55º 4' 8.3" W, 485 m.s.m., 5.V.2011, *J.F.M. Valls, D.M. Ramos & S.N. Moreira 15563* (CEN, CGMS, CTES, UB).

Distribution and habitat: *Arachis sesquijuga* is known only from the type location, in areas of red soil with open cerrado grasslands, now highly disturbed by agricultural use with sugarcane, soybeans, maize, cotton and exotic grass pastures. Plants survive as encroachers in roadside stretches visually overtaken by African grasses. They quickly sprout and flower, and also germinate, if the dominant grasses are burnt in sporadic fires; otherwise, although present in the area, the scattered groups of *Arachis* plants are quite difficult to spot.

Obs. I. Measurements above were taken from the holotype; data in parenthesis from isotypes and paratype, flower data from paratype only. Fruit and seed dimensions, as well as cytological data, were obtained from germplasm collected at the original site in nature.

Obs. II. Presence of an evident rachis, 1.6-4.3 mm long, making the leaf clearly imparipinnate, is the most obvious differential character of this new trifoliolated species. Leaves of *A. guaranitica* and *A. tuberosa* may present a brief elongation of the petiole at the insertion of the central leaflet, however never reaching 1.0 mm of lenght.

Obs. III. The sectional affiliation of *A. sesquijuga* is still uncertain. It shares the diploid 2n=20 chromosome number of the species of *sect. Trierectoides* and the several potentially sympatric members of *sect. Erectoides* (Mendes, 1947; Fernández & Krapovickas, 1994; Lavia, 2001). But it has not been established, so far, whether its pinnate-trifoliolate leaves derive from pinnate-tetrafoliolate ones, by reduction, or if the species diverged from the trierectoid species by the elongation of a rachis.

Obs. IV. The new species occurs in the southwestern limits of distribution of *A. tuberosa*, and north of the documented area of occurrence of *A. guaranitica* in Brazil and Paraguay.

Etymology: The specific epithet refers to the pinnate leaves bearing only three leaflets, a strong diagnostic feature to differentiate this peculiar species in the genus *Arachis*.

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